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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF
PESTICIDES AND
TOXIC
SUBSTANCES

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MEMORANDUM

Bar codes: D253952, D254316, D254075, D253660

SUBJECT: EFED's Section 3 Registration Eligibility Decision Chapter for Fipronil Use as Granular and Bait applications for control of Fire Ants and Other Turf pests.

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THRU:

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TO:

Ann Sibold, PM Team Reviewer
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The Environmental Fate and Effects Division (EFED) has completed its review of potential ecological risks associated with a FIFRA Section 3 registration of fipronil as a broadcast granular application and as a bait application for the control of fire ants and other turfgrass insects. This risk assessment evaluates the potential risks to birds, fish, and aquatic invertebrates and non-target insects associated with the above uses of fipronil.

The surface water residue characterization for this assessment utilizes Tier 1 GENECC modeling (no monitoring data are available and no Tier 2 modeling scenarios are available for EFED application to turf grass pesticide applications). A surface water source drinking water assessment for these turf uses was not conducted. Based on application rates and the limitations of modeling for turf application scenarios, it is believed that drinking water assessments for rice, cotton, and corn uses are more conservative and supportable at this time for establishing drinking water exposure levels.



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Modeled exposures to fipronil exceed the high acute risk for non-endangered bird species in the 20 g body weight class for all granular application scenarios. Furthermore there is a presumption that granular formulations under maximum single and multiple applications pose risks to larger weight class birds (180 g), such that restricted use and/or endangered species levels of concern are triggered. Bait formulations, under the proposed use scenarios, do not appear to present exposure levels of fipronil that are above any avian risk levels of concern. Slit-application of granular formulations, as suggested on the Chipco® 61748A product label, would likely reduce the proportion of granules on the surface although the degree to which slit application reduces surface granular residue is unknown. This would reduce potential avian exposure to granules. A possible risk mitigation for the protection of avian species would be to encourage the use of slit-application equipment for the control of mole crickets and the use of bait formulations for the control of fire ants and nuisance ants.

Tier I surface water modeling (GENEEC) results suggests that the fipronil photodegrate MB46513 may be presumed to be an acute risk to endangered freshwater fish under the minimum granular application rate scenario. However, under the maximum granular application rate scenario, MB46513 exceeds the acute restricted use level of concern established by the Environmental Fate and Effects Division for freshwater fish, and parent fipronil exceeds the endangered freshwater fish acute level of concern. All application rates modeled for granular fipronil and degradates exceed the acute high risk level of concern for estuarine/marine invertebrates, and MB46513 exceeds the endangered estuarine/marine fish level of concern. Bait formulations of fipronil do not result in estimate exposures that exceed any acute or chronic levels of concern for aquatic organisms.

Given the very high toxicity of fipronil to honey bees, it is likely that application of fipronil to turf grass areas will result in effects to non-target insects. The extent to which non-target insects include endangered species in the proposed use sites is beyond information available to EFED at this time.

EFED recommends that this section 3 risk assessment be forwarded to FEAD for comment on endangered species issues for terrestrial and aquatic vertebrates and invertebrates.

Fipronil
Environmental Fate and Ecological Effects
Assessment and Characterization
for a Section 3 for Broadcast Treatment with
Granular Product and Baits to Control Turf Insects and Fire Ants

EXECUTIVE SUMMARY

This risk assessment evaluates the potential risks to birds, fish, and aquatic invertebrates associated with the use of fipronil granular products as turf treatments for control of selected insect pests as well as mound and broadcast bait treatments for fire ant control. Mammalian wildlife risks were not evaluated directly, but the lower acute toxicity of Fipronil to mammals versus birds suggests that equivalent exposures will result in lower risks for mammals than birds. Therefore, Fipronil levels protective of birds are expected to be correspondingly protective of mammalian wildlife.

A surface water source drinking water assessment for these turf uses was not conducted. Based on application rates and the limitations of modeling for turf application scenarios, it is believed that drinking water assessments for rice, cotton, and corn uses are more conservative and supportable at this time for establishing drinking water exposure levels. For such detailed fate information, the reader is referred to the EFED risk assessments conducted for corn and rice wet-seed uses.

This risk assessment indicates that, under the granular use scenarios investigated, there is a presumption of risk to avian species. Modeled exposures exceed the high acute risk for non-endangered bird species in the 20 g body weight class for all granular application scenarios. Furthermore there is a presumption that granular formulations under maximum single and multiple applications pose risks to larger weight class birds (180 g), such that restricted use and/or endangered species levels of concern are triggered. Bait formulations, under the proposed use scenarios, do not appear to present exposure levels of Fipronil that are above any avian risk levels of concern.

Tier I surface water modeling (GENEEC) results suggests that the Fipronil photodegradeate MB46513 may be presumed to be an acute risk to endangered freshwater fish under the minimum granular application rate scenario. However, under the maximum granular application rate scenario, MB46513 exceeds the acute restricted use level of concern established by the Environmental Fate and Effects Division for freshwater fish, and parent Fipronil exceeds the endangered freshwater fish acute level of concern. All application rates modeled for granular Fipronil and degradates exceed the acute high risk level of concern for estuarine/marine invertebrates, and MB46513 exceeds the endangered estuarine/marine fish level of concern. Bait formulations of Fipronil do not result in estimate exposures that exceed any acute or chronic levels of concern for aquatic organisms.

The assessment suggests that terrestrial and aquatic endangered species may be at acute risk from use of Fipronil granular formulations on turf grasses. EFED does not have sufficient geographical information on the specific areas of Fipronil use (such are likely to be widespread) to determine if endangered species occur within the proposed sites of use.

Slit-application of granular formulations, as suggested on the Chipco® 61748A product label,

would likely reduce the proportion of granules on the surface although the degree to which slit application reduces surface granular residue is unknown. This would reduce potential avian exposure to granules. A possible risk mitigation for the protection of avian species would be to encourage the use of slit-application equipment for the control of mole crickets and the use of bait formulations for the control of fire ants and nuisance ants.

USE PROFILE

Chemical Identification

The subject chemical of this risk assessment is identified by the trade chemical name Fipronil. The chemical identification number is 129121. The Chemical Abstract System number is 061662.

Type of Use

Fipronil is an insecticide.

Site of Use

The proposed use site is turf grass, including domestic lawns, sports fields, sod farms, commercial lawns, cemeteries, parks, recreational areas, and golf turf.

Target Pest

The target pests include fire ants, black and nuisance ants, mole crickets, fleas, and ticks.

Formulation Type

The labeled formulation of Fipronil proposed for registration on turf grass include:

1. H&G 61748A, a granule for broadcast treatment
2. Chipco® 61748A, a granule for broadcast treatment
3. Chipco® 61442A, a bait for broadcast and fire ant mound treatment.

Rate and Timing of Application

H&G 61748A

The recommended application for H&G 61748A is 10 pounds of product per 5000 square feet. Using a labeled active ingredient concentration of 0.0143%, the Fipronil application rate is 0.00143 lb a.i./5000 square feet or 0.0124 lb a.i./acre. There is no soil incorporation. Two application per year are allowed according to the label for a maximum annual application of 0.0249 lb a.i./acre. No specific interval between application are specified. However, the label

does suggest that flea and tick control is provided for 30 days after application and fire ant control begins 7 to 14 days after initial treatment, with up to 4-weeks required for 100% control. The label states that applications may occur anytime between mid-March to mid-October.

Chipco® 61748A

The recommended application for Chipco® 61748A is 2 to 4 pounds of product per 1000 square feet. Using a labeled active ingredient concentration of 0.0143%, the Fipronil application rate is 0.000286 to 0.000572 lb a.i./1000 square feet or 0.0124 to 0.0249 lb a.i./acre. There is no soil incorporation of broadcast application, but slit treatment is a labeled option and the label recommends watering in of treatments for flea and tick control. Two application per year are allowed according to the label for a maximum annual application of 0.05 lb a.i./acre. No specific interval between application are specified. However, the label does suggest that flea and tick control is provided for 30 days after application.

Chipco® 61442A

The recommended application for Chipco® 61442A is 1.5 to 15 pounds of product per acre for either broadcast or mound treatments. Using a labeled active ingredient concentration of 0.00015%, the Fipronil application rate is 0.00000225 to 0.0000225 lb a.i./acre. There is no soil incorporation. Four applications per year are allowed according to the label for a maximum annual application of 0.000009 to 0.00009 lb a.i./acre. No specific interval between application are specified. However, the label does suggest that flea and tick control is provided for 30 days after application. Fire ant control begins at 14 days after initial treatment, with up to 4-weeks required for 100% control.

TOXICOLOGICAL CHARACTERIZATION

The mechanism of toxicity of Fipronil is through the gamma-amino butyric acid neurotransmission system, interfering with the chloride channel.

Toxicity to Birds

Tables 1, 2, and 3 summarize the available avian toxicity data for Fipronil and its predominate environmental degradates.

Table 4 presents the avian toxicological thresholds for Fipronil and the photodegrate MB46513. The photodegrate was selected for evaluation in the avian risk assessment because the broadcast use of Fipronil results in application of bait and granules above ground and subject to exposure to sunlight and therefore photodegradation. The selection of toxicity thresholds for this risk assessment concentrated on the acute avian single oral dose data, consistent with EFED methods for assessing risk for granular applications.

Toxicity to Aquatic Animals

Tables 5 through 8 present the aquatic organism toxicity data for Fipronil and degradates for freshwater and estuarine fish and invertebrates.

Table 9 presents the aquatic organism toxicity thresholds used in the assessment of risks to aquatic organisms. The table also presents the procedures to estimate toxicity endpoints for those degradates with no actual study information. The procedures generally involve using chronic:acute toxicity ratios relationships between freshwater organism toxicity endpoints for Fipronil and a particular degrade to modify existing toxicity data for the degrade or parent Fipronil. If there were insufficient data to make such comparisons, the degrade was assumed to be as toxic as parent Fipronil.

Toxicity to Non-Target Insects

Available data suggest that Fipronil is extremely toxic to honeybees via direct contact or oral ingestion of Fipronil residues with LD50 values of 0.00593 and 0.00417 $\mu\text{g ai/bee}$ for contact and oral exposures, respectively.

EXPOSURE ASSESSMENT

Avian Exposure Assessment

Birds may be exposed to granular pesticides ingesting granules when foraging for food or grit. They also may be exposed by other routes, such as by walking on exposed granules or drinking water contaminated by granules. The number of lethal doses (LD50s) that are available within one square foot immediately after application (LD50s/ft^2) is used as the risk quotient for granular/bait products. Risk quotients are calculated for three separate weight class of birds: 1000 g (e.g., waterfowl), 180 g (e.g., upland gamebird), and 20 g (e.g., songbird).

For the purposes of the risk assessment for granular formulations, three application rates were considered. The first is for a single minimum application of 0.000286 lb a.i./1000 square feet or 0.000000286 lb a.i./square foot. The second is for a maximum single application of 0.000572 lb a.i./1000 square feet or 0.000000572 lb a.i./square foot, this would also be equivalent to two minimum rate applications without any granule dissipation between applications. The third is the sum of two maximum applications, with no accounting for granule degradation, or 0.00000114 lb a.i./square foot. Because nuisance ant and fire ant control does not require the watering in process recommended for flea and tick control, watering in was not considered quantitatively in the risk assessment. EFED currently does not have a method for assessing the impact of watering in of granules on avian exposure.

The assessment for bait formulations of Fipronil were based on a single application of 0.0000225 lb a.i./acre or 5.16×10^{-10} lb a.i./square foot. A second risk assessment exposure estimate for bait

use was based on the sum of our applications at the single application rate, with no assumed Fipronil dissipation, for a total of 2.64×10^{-9} lb a.i./square foot.

The reader should note that, although the Fipronil soil photodegrade MB46513 is more acutely toxic than the parent compound (LD_{50} of 5 mg/kg versus 11.3 mg/kg in bobwhite quail), EFED currently does not have an exposure modeling method for estimating avian exposure to metabolites under granular application conditions. However, the low level of formation of this degrade in soil photodegradation studies (8% of applied parent compound), the absence of exposure modeling for this metabolite is not expected to greatly influence the conclusions of the risk assessment.

AQUATIC EXPOSURE ASSESSMENT

Tier 1 (GENEEC) surface water modeling was conducted for the turf grass application of granular and bait formulations of Fipronil. The minimum granular application rate for surface water modeling was 0.0125 lb a.i./acre, with a maximum of two applications per year, yielding a maximum annual application of 0.025 lb ai/acre. The maximum granular application rate for surface water modeling was 0.025 lb a.i./acre, with two applications per year yielding a maximum annual application of 0.05 lb a.i./acre. No soil incorporation was assumed. The application interval was conservatively set at 7 days, the minimal period post treatment that pest control may be observed. The maximum bait application rate for surface water modeling was 0.0000225 lb a.i./acre, with four applications per year yielding a maximum annual application of 0.00009 lb a.i./acre. No soil incorporation was assumed. The application interval was conservatively set at 14 days, the minimal period post treatment that pest control may be observed.

Table 10 summarizes the input parameters for GENECC modeling. Table 11 summarizes the estimated surface water concentrations for Fipronil and degradates for each application scenario. The reader should note that application rates (and subsequent estimated water concentrations) for degradates are based on maximum degrade residues from laboratory studies as fraction of applied parent material.

DRINKING WATER ASSESSMENT

A surface water source drinking water assessment for these turf uses was not conducted. Based on application rates and the limitations of modeling for turf application scenarios, it is believed that drinking water assessments for rice, cotton, and corn uses are more conservative and supportable at this time for establishing drinking water exposure levels.

RISK ASSESSMENT and CHARACTERIZATION

Risk Quotient (RQ) and the Levels of Concern (LOC)

Risk characterization integrates the results of the exposure and ecotoxicity data to evaluate the likelihood of adverse ecological effects. The means of this integration is called the quotient method. Risk quotients (RQs) are calculated by dividing acute and chronic exposure estimates by toxicity values.

$$RQ = \text{EXPOSURE} / \text{TOXICITY}$$

RQs are then compared to OPP's levels of concern (LOCs). These LOCs are used by OPP to analyze potential risk to nontarget organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories: (1) acute high -- potential for acute risk is high; regulatory action may be warranted in addition to restricted use classification, (2) acute restricted use -- the potential for acute risk is high, but may be mitigated through restricted use classification, (3) acute endangered species - endangered species may be adversely affected, and (4) chronic risk - the potential for chronic risk is high, regulatory action may be warranted. Currently, EFED does not perform assessments for chronic risk to plants, acute or chronic risks to nontarget insects, or chronic risk from granular/bait formulations to birds or mammals.

The ecotoxicity test values (measurement endpoints) used in the acute and chronic risk quotients are derived from required studies. Examples of ecotoxicity values derived from short-term laboratory studies that assess acute effects are: (1) LC50 (fish and birds), (2) LD50 (birds and mammals), (3) EC50 (aquatic plants and aquatic invertebrates) and (4) EC25 (terrestrial plants). Examples of toxicity test effect levels derived from the results of long-term laboratory studies that assess chronic exposure-related effects are: (1) LOAEC (birds, fish, and aquatic invertebrates) and (2) NOAEC (birds, fish and aquatic invertebrates). For birds and mammals, the NOAEC generally is used as the ecotoxicity test value in assessing chronic exposure risks, although other values may be used when justified. Generally, the NOAEC is used as the ecotoxicity test value in assessing chronic exposure risks to fish and aquatic invertebrates.

Risk presumptions and the corresponding RQs and LOCs, are tabulated below.

Risk Presumptions for Terrestrial Animals

Risk Presumption	RQ	LOC
<u>Birds</u>		
Acute High Risk	EEC ¹ /LC50 or LD50/sqft ² or LD50/day ³	0.5
Acute Restricted Use	EEC/LC50 or LD50/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2

Risk Presumptions for Terrestrial Animals

Risk Presumption	RQ	LOC
Acute Endangered Species	EEC/LC50 or LD50/sqft or LD50/day	0.1
Chronic Risk	EEC/NOEC	1

¹ abbreviation for Estimated Environmental Concentration (ppm) on avian/mammalian food items

² $\frac{\text{mg}}{\text{ft}^2}$ ³ $\frac{\text{mg of toxicant consumed}}{\text{day}}$
 LD50 * wt. of bird LD50 * wt. of bird

Risk Presumptions for Aquatic Animals

Risk Presumption	RQ	LOC
Acute High Risk	EEC ¹ /LC50 or EC50	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/MATC or NOEC	1

¹ EEC = (ppm or ppb) in water

Risk Assessment for Birds

The acute risk quotients for broadcast applications of granular and bait formulations are listed in Table 12. Under an assumption of minimum single application rate, no acute risk Levels of Concern (LOCs) are exceeded for birds in any weight category. For the maximum single application rate of granular formulation, and for the sum of two minimum applications, all the EFED acute risk LOCs are exceeded for 20 g birds, and the endangered species LOC are exceeded for 180 gram birds. Under the application scenario for two maximum applications of granular Fipronil the acute high risk, restrictive use, and endangered species LOCs are exceeded for 20 g birds; and the restricted use and endangered species levels of concern are exceeded for 180 g birds.

No acute LOCs are exceeded by any bait formulation application scenario for Fipronil.

Currently, EFED has no risk assessment methodology for evaluating the potential for risks to birds from long-term exposure via the ingestion and contact with granular formulations.

Risk to Aquatic Animals

Tables 13 through 15 present the calculations of acute and chronic risk quotients for aquatic organisms.

Under the minimum granular application rate scenario, only the endangered species acute level of concern for freshwater fish and invertebrates and estuarine/marine fish, is exceeded by predicted maximum water concentrations of Fipronil or degradates. This excursion above the acute endangered species level of concern is limited to MB46513 and only for the freshwater fish. However, predicted water concentrations of Fipronil, MB46136, MB46513, and MB45950 exceed the acute toxicity thresholds established for estuarine invertebrates at levels high enough to trigger the EFED acute high risk LOC. The EFED chronic exposure LOC is exceeded for estuarine/marine fish and invertebrates for Fipronil and all degradates (excepting MB45950 in marine/estuarine fish).

Under the maximum granular application scenario, Fipronil, exceeds the acute endangered species LOC for freshwater fish, and MB46513 exceeds the acute restricted use LOC for the same organisms. Freshwater invertebrate acute risk quotients do not exceed any EFED LOC. Fipronil and MB46513 risk quotients for estuarine/marine fish exceed the endangered species acute risk LOC. Estimated water concentrations of Fipronil and all degradates are high enough to result in risk quotients that exceed the acute high risk LOC for estuarine/marine invertebrates. The EFED chronic exposure LOC is exceeded for estuarine/marine fish and invertebrates for Fipronil and all degradates (excepting MB45950 in marine/estuarine fish).

The aquatic organism risk quotients for application of bait formulations of Fipronil do not exceed any acute or chronic LOCs.

Risks to Non-Target Insects

EFED, currently does not have a quantitative method for assessing risks to non-target insects. Given its high toxicity to beneficial insects such as honey bees, application of Fipronil to turf grass areas is likely to impact non-target insects.

Endangered Species

Assessment of potential risks to avian endangered species is limited by the receptor species selection process incorporated into this risk assessment. Direct application of the risk quotients calculated for avian receptors should be limited to endangered species of similar bodyweights and similar dietary habits. To this end, the calculated risk quotients suggest a potential for acute and chronic risks to endangered avian species that may (if any) utilize turf grass areas.

Aquatic EECs suggest that minimum and maximum application scenarios for granular Fipronil formulations have the potential to result in surface water concentrations of Fipronil and some degradates at levels high enough to pose an acute and chronic risk to endangered species, should exposure occur.

The proposed use sites for Fipronil granular and bait formulations addressed in this risk assessment include domestic lawns, sports fields, sod farms, commercial lawns, cemeteries, parks,

recreational areas, and golf turf. These areas are likely to be widely distributed across the country and the types of pests proposed for control by the formulations are also likely to be widely distributed. Consequently, EFED does not have sufficient resolution on potential use site locations to pinpoint geographic overlap with known occurrence of terrestrial or aquatic endangered species. EFED is aware that the Florida scrub jay and the Nashville crayfish are endangered species associated with some proposed use sites under the granular and bait formulation labels addressed in this risk assessment (personal communication, Larry Turner, USEPA/OPP/FEAD).

Risk Characterization

Avian Risk Characterization

The assessment suggests that small songbirds (ca. 20 g in body weight) are at the highest risk from exposure to granular Fipronil and that two applications at the minimum application rate, a single maximum application, and two consecutive applications at the maximum rates presumably offer the highest exposure potential. It is likely that birds of this size category are prevalent in a variety of habitat types in proximity to turf use sites for Fipronil.

The present risk assessment makes no allowances for avoidance behavior under granular application scenarios as no data are available specific to the granular formulations proposed for registration. Furthermore, the assessment does not consider higher exposures in areas of mixer/loader operations or at turn-around areas for application equipment operation. Although degradation of Fipronil granules was not considered in this assessment (likely an overestimation of exposure for multiple applications if granule degradation is rapid) the assessment for avian risks does not consider risks from chronic exposure to Fipronil residues in soil, nor does it consider acute and chronic risks from Fipronil degradates (EFED-approved methods for estimating such exposure scenarios are not currently available). Furthermore, granule dissolution in puddles of in-field drinking water and dermal contact with granules are not directly quantified under the current exposure estimation methods.

Aquatic Organism Risk Assessment

Risks predicted for Fipronil and degradates in this assessment are based on surface water concentrations of the compounds as approximated under the closed pond system assumed under the GENEEC model. No dilution effects in lotic receiving waters have been factored into the assessment. EFED does not have sufficient specific information of the hydrology of such systems in proximity to the variety of turf use sites for Fipronil granules and baits to determine such dilution effects.

LABELING AND POTENTIAL FOR MITIGATION

The label for H&G 61748A should include the following information:

This pesticide is toxic to birds, fish, and aquatic invertebrates. Do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high water mark. Runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Cover, incorporate, or clean up granules that are spilled. Do not contaminate water when disposing of equipment wash water or rinsate.

The labels for Chipco® 61748A suggests that the formulation can be applied by slit-application equipment. This equipment would reduce the above-ground proportion of granules and thereby reduce the potential exposure of birds to these granules. An incorporation efficiency of as little as 90% would reduce exposures by an order of magnitude and therefore reduce potential risks below acute high risk levels of concern. The reader should note that, while slit-application is useful for mole crickets, it is not likely to be effective for fire ants and other insect pests on the proposed granular labels. However, bait formulations for fire ant control are of lower risk to avian and aquatic organisms and steps to encourage their use in place of granule applications would reduce terrestrial and aquatic wildlife exposures to Fipronil associated with the chemical's use to control fire ants.

Table 1. Avian Single Oral Dose Toxicity Data for Fipronil and Degradates

Species	Chemical	%A.I.	LD50 mg/kg	MRID	Classification
Northern bobwhite	fipronil	96	11.3	42918617	core
Mallard	fipronil	96.8	>2150	42918616	core
Pigeon	fipronil	97.7	>500	42918613	supplemental
Red-legged partridge	fipronil	95.4	34	42918614	supplemental
Pheasant	fipronil	95.4	31	42918615	supplemental
House sparrow	fipronil	96.7	1000	42918618	supplemental
Northern bobwhite	MB46513	99.7	5	43776601	supplemental
Mallard duck	MB46513	98.6	420	43776602	supplemental
Northern bobwhite	fipronil (1.6 WG)	1.6	1065	42918619	supplemental

Table 2. Avian Subacute Dietary Toxicity for Fipronil

Species	Chemical	%A.I.	LC50 mg/kg-diet	MRID	Classification
Northern bobwhite	fipronil	95	48	42918620	core
Mallard duck	fipronil	95	>5000	42918621	core

Table 3. Avian Reproductive Toxicity for Fipronil

Species	Chemical	%A.I.	LOEC mg/kg-diet	NOEC mg/kg-diet	MRID	Classification
Northern bobwhite	fipronil	96.7	>10	10	42918622	supplemental
Mallard duck	fipronil	96.7	>1000	1000	42918623	core

Table 4. Avian Toxicity Thresholds Used in the Fipronil Fire Ant/Turf Pest Risk Assessment

Chemical	Acute Toxicity Threshold mg/kg	Acute Threshold Origin
Fipronil	11.3	1
MB46513	5	1

1 most sensitive species tested

Table 5. Fish Acute Toxicity for Fipronil and Degradates

Species	Chemical	%A.I.	LC50 ug/L	MRID	Classification
Bluegill sunfish	fipronil	100	83	42918624	core
Rainbow trout	fipronil	100	246	42977902	core
Rainbow trout	MB46136	99.2	39	42918673	supplemental
Bluegill sunfish	MB46136	99.2	25	42918674	supplemental
Bluegill sunfish	MB46513	no data	20	DPR 157298	
Rainbow trout	MB46513	94.7	>100,000	43291718	supplemental
Rainbow trout	MB46513	100	>100,000	43279703	core
Sheepshead minnow	fipronil	96.1	130	43291702	core

Table 6. Fish Chronic Exposure Toxicity for Fipronil

Species	Chemical	%A.I.	LOEL ug/L	NOEL ug/L	Effect	MRID	Classification
Rainbow trout	fipronil	96.7	15	6.6	larval length	42918627	core
Sheepshead minnow	fipronil	97	0.41	0.24	length, weight	44605502	core

Table 7. Aquatic Invertebrate Acute Toxicity for Fipronil and Degradates

Species	Chemical	%A.I.	EC50 ug/L	MRID	Classification
<i>Daphnia magna</i>	fipronil	100	190	42918625	core
<i>Daphnia magna</i>	RPA 10461	94.7	100,000	43291719	supplemental
<i>Daphnia magna</i>	MB46136	100	29	42918671	supplemental
<i>Daphnia magna</i>	MB46950	100	100	42918669	supplemental
<i>Crassostrea virginica</i>	fipronil	96.1	770	43291701	core
<i>Mysidopsis bahia</i>	fipronil	96.1	0.14	43279701	core

Table 8. Aquatic Invertebrate Chronic Exposure Toxicity for Fipronil and Degradates

Species	Chemical	%A.I.	LOEL ug/L	NOEL ug/L	Effect	MRID	Classification
<i>Daphnia magna</i>	fipronil	100	20	9.8	length	42918626	supplemental
<i>Mysidopsis bahia</i>	fipronil	97.7	0.005	none	survival, growth, reproduction	43681201	supplemental
<i>Daphnia magna</i>	MB46513	no data	100	41	growth	DPR 15730	no DER
<i>Daphnia magna</i>	MB46136	no data	1.5	0.63	weight	DPR 15730	no DER
<i>Daphnia magna</i>	MB46950	no data	22	13	reproduction, growth	DPR 15730	no DER

DPR - California Department of Pesticide Regulation Study Number - Note: these studies not reviewed by EPA

Table 9. Aquatic Organism Toxicity Thresholds Used in the Fipronil Fire Ant/Turf Pest Risk Assessment

Chemical	Acute Toxicity Threshold ug/L	Chronic Toxicity Threshold ug/L	Acute Threshold Origin	Chronic Threshold Origin
Freshwater Fish				
Fipronil	83	6.6	1	1
MB46136	25	2.0	1	2
MB46513	20	1.6	1	2
MB45950	83	6.6	3	3
Freshwater Invertebrates				
Fipronil	190	9.8	1	1
MB46136	29	0.63	1	1
MB46513	190	41	3	1
MB45950	100	13	1	1
Estuarine Fish				
Fipronil	130	0.24	1	1
MB46136	39	0.07	4	5
MB46513	31	0.06	4	5
MB45950	130	0.24	3	3
Estuarine Invertebrates				
Fipronil	0.14	0.005	1	1
MB46136	0.02	0.0003	6	7
MB46513	0.14	0.005	3	3
MB45950	0.07	0.007	6	7

1 most sensitive species tested

2 most sensitive species tested acute value Xmultiplied by chronic:acute ratio of parent fipronil

3 assumed to be equivalent to parent fipronil

4 parent fipronil acute value multiplied by metabolite:parent fipronil ratio for freshwater fish acute values

5 parent fipronil chronic value multiplied by metabolite:parent fipronil ratio for freshwater fish acute values

6 acute freshwater metabolite.value multiplied by acute estuarine:acute freshwater ratio for parent fipronil

7 chronic freshwater for metabolite multiplied by chronic estuarine:chronic freshwater ratio for parent fipronil

Table 10. GENEEC Model Input Parameters for Fipronil and Degradates

Parameter	Fipronil	MB 46136	MB 46513	MB 45950
Mean Koc (mL/g)	727	4208	1290	2719
Aerobic Soil Metabolism Half-life (days)	128	Stable*	Stable	Stable
Aqueous Photolysis Half-life (days)	0.16	7	Stable	Stable
Hydrolysis Half-life	Stable	Stable	Stable	Stable
Aerobic Aquatic Metabolism Half-life	Stable	Stable	Stable	Stable
Water Solubility (mg/L)	2.4	0.16	0.95	0.1
Application Rates (lbs a.i./acre) **				
granular minimum	0.125	0.03	0.05375	0.00625
granular maximum	0.25	0.06	0.1075	0.0125
bait maximum	2.25E-05	5.4E-06	9.675E-06	1.125E-06
Number of Applications				
granular	2	2	2	2
bait	4	4	4	4
Application Interval (days)				
granular	7	7	7	7
bait	14	14	14	14

* stable fate inputs are assigned value of 0 in GENEEC model

** application rates for degradates are based on parent application rate multiplied by fate study fractions of formation (MB46136 24%, MB46513 43%, MB45950 5%)

Table 11. Water Concentrations of Fipronil and Degradates

Chemical	Peak Water Concentration (ug/L)	21-day Average Water Concentration (ug/L)	56-day Average Water Concentration (ug/L)
Granular Minimum Application Rate 0.125 lb a.i./acre X 2			
Fipronil	3.87E+00	2.50E+00	1.41E+00
MB46136	2.58E-01	1.53E-01	1.03E-01
MB46513	1.12E+00	9.30E-01	7.40E-01
MB45950	7.40E-02	5.20E-02	3.70E-02
Granular Maximum Application Rate 0.25 lb a.i./acre X 2			
Fipronil	7.74E+00	5.01E+00	2.83E+00
MB46136	5.17E-01	3.08E-01	2.06E-01
MB46513	2.24E+00	1.85E+00	1.48E+00
MB45950	1.48E-01	1.04E-01	7.40E-02
Bait Maximum Application Rate 2.25 E-05 lb a.i./acre X 2			
Fipronil	1.27E-03	8.20E-04	4.60E-04
MB46136	9.00E-05	6.00E-05	4.00E-05
MB46513	4.00E-04	3.30E-04	2.70E-04
MB45950	3.00E-05	2.00E-05	1.00E-05

MRD

-0.025 lbs a.i./A

Table 12. Avian Risk Quotient Calculations for Fipronil

Wildlife Food Item	Bird Mass (g)	Most Sensitive Avian Species LD50 (mg/kg)	Total Dose Normalized for Bird Weight (mg)	Application Rate (lb /square foot)	Application Rate (mg/square foot)	Acute RQ
Fipronil						
Granular formulation (single minimum application)	1000	11.3	11.30	2.86E-07	1.30E-01	0.011
	180		2.03			0.064
	20		0.23			0.573
Granular formulation (single maximum application)	1000	11.3	11.30	5.72E-07	2.59E-01	0.023
	180		2.03			0.127
	20		0.23			1.146
Granular formulation (two maximum applications)	1000	11.3	11.30	1.14E-06	5.18E-01	0.046
	180		2.03			0.255
	20		0.23			2.292
Bait formulation (single maximum application)	1000	11.3	11.30	5.16E-10	2.34E-04	0.00002
	180		2.03			0.00012
	20		0.23			0.001
Bait formulation (four maximum applications)	1000	11.3	11.30	2.64E-09	1.20E-03	0.0001
	180		2.03			0.001
	20		0.23			0.005

Risk Presumption	RQ	LOC
Acute High Risk	EEC/LC50	0.5
Acute Restricted Use	EEC/LC50	0.2
Acute Endangered Species	EEC/LC50	0.1
Chronic Risk	EEC/NOEC	1

Table 13. Aquatic Organism Risk Quotient Calculations for Fipronil and Degradates Under Minimum Granular Application Rate Scenario

Chemical	Acute Toxicity Threshold ug/L	Chronic Toxicity Threshold ug/L	Peak Water Concentration ug/L	Acute RQ	21-day Average Water Concentration ug/L	56-day Average Water Concentration ug/L	Chronic RQ
Freshwater Fish							
Fipronil	83	6.6	3.87E+00	0.04662651		1.41E+00	0.21
MB46136	25	2.0	2.58E-01	0.01032		1.03E-01	0.05
MB46513	20	1.6	1.12E+00	0.056		7.40E-01	0.47
MB45950	83	6.6	7.40E-02	0.00089157		3.70E-02	0.01
Freshwater Invertebrates							
Fipronil	190	9.8	3.87E+00	0.02036842	2.50E+00		0.26
MB46136	29	0.63	2.58E-01	0.00889655	1.53E-01		0.24
MB46513	190	41	1.12E+00	0.00589474	9.30E-01		0.02
MB45950	100	13	7.40E-02	0.00074	5.20E-02		0.00
Estuarine Fish							
Fipronil	130	0.24	3.87E+00	0.02976923		1.41E+00	5.88
MB46136	39	0.07	2.58E-01	0.00658892		1.03E-01	1.42
MB46513	31	0.06	1.12E+00	0.03575385		7.40E-01	12.80
MB45950	130	0.24	7.40E-02	0.00056923		3.70E-02	0.15
Estuarine Inveterbrates							
Fipronil	0.14	0.005	3.87E+00	27.6428571	2.50E+00		500.00
MB46136	0.02	0.0003	2.58E-01	12.0738916	1.53E-01		476.00
MB46513	0.14	0.005	1.12E+00	8	9.30E-01		186.00
MB45950	0.07	0.007	7.40E-02	1.00428571	5.20E-02		7.84

Risk Presumption	RQ	LOC
Acute High Risk	EEC/LC50 or EC50	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/NOEC	1

Table 14. Aquatic Organism Risk Quotient Calculations for Fipronil and Degradates Under Maximum Granular Application Rate Scenario

Chemical	Acute Toxicity Threshold ug/L	Chronic Toxicity Threshold ug/L	Peak Water Concentration ug/L	Acute RQ	21-day Average Water Concentration ug/L	56-day Average Water Concentration ug/L	Chronic RQ
Freshwater Fish							
Fipronil	83	6.6	7.74E+00	0.093253		2.83E+00	0.43
MB46136	25	2.0	5.17E-01	0.02068		2.06E-01	0.10
MB46513	20	1.6	2.24E+00	0.112		1.48E+00	0.93
MB45950	83	6.6	1.48E-01	0.001783		7.40E-02	0.01
Freshwater Invertebrates							
Fipronil	190	9.8	7.74E+00	0.040737	5.01E+00		0.51
MB46136	29	0.63	5.17E-01	0.017828	3.08E-01		0.49
MB46513	190	41	2.24E+00	0.011789	1.85E+00		0.05
MB45950	100	13	1.48E-01	0.00148	1.04E-01		0.01
Estuarine Fish							
Fipronil	130	0.24	7.74E+00	0.059538		2.83E+00	11.79
MB46136	39	0.07	5.17E-01	0.013203		2.06E-01	2.85
MB46513	31	0.06	2.24E+00	0.071508		1.48E+00	25.59
MB45950	130	0.24	1.48E-01	0.001138		7.40E-02	0.31
Estuarine Invertebrates							
Fipronil	0.14	0.005	7.74E+00	55.28571	5.01E+00		1002.00
MB46136	0.02	0.0003	5.17E-01	24.19458	3.08E-01		958.22
MB46513	0.14	0.005	2.24E+00	16	1.85E+00		370.00
MB45950	0.07	0.007	1.48E-01	2.008571	1.04E-01		15.68

Risk Presumption	RQ	LOC
Acute High Risk	EEC/LC50 or EC50	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/NOEC	1

Table 15. Aquatic Organism Risk Quotient Calculations for Fipronil and Degradates Under Minimum Granular Application Rate Scenario

Chemical	Acute Toxicity Threshold ug/L	Chronic Toxicity Threshold ug/L	Peak Water Concentration ug/L	Acute RQ	21-day Average Water Concentration ug/L	56-day Average Water Concentration ug/L	Chronic RQ
Freshwater Fish							
Fipronil	83	6.6	1.27E-03	1.5E-05		4.60E-04	0.00007
MB46136	25	2.0	9.00E-05	3.6E-06		4.00E-05	0.00002
MB46513	20	1.6	4.00E-04	2E-05		2.70E-04	0.00017
MB45950	83	6.6	3.00E-05	3.6E-07		1.00E-05	0.000002
Freshwater Invertebrates							
Fipronil	190	9.8	1.27E-03	6.7E-06	8.20E-04		0.00008
MB46136	29	0.63	9.00E-05	3.1E-06	6.00E-05		0.00010
MB46513	190	41	4.00E-04	2.1E-06	3.30E-04		0.00001
MB45950	100	13	3.00E-05	3E-07	2.00E-05		0.000002
Estuarine Fish							
Fipronil	130	0.24	1.27E-03	9.8E-06		4.60E-04	0.00192
MB46136	39	0.07	9.00E-05	2.3E-06		4.00E-05	0.00055
MB46513	31	0.06	4.00E-04	1.3E-05		2.70E-04	0.00467
MB45950	130	0.24	3.00E-05	2.3E-07		1.00E-05	0.00004
Estuarine Inveterbrates							
Fipronil	0.14	0.005	1.27E-03	0.00907	8.20E-04		0.16400
MB46136	0.02	0.0003	9.00E-05	0.00421	6.00E-05		0.18667
MB46513	0.14	0.005	4.00E-04	0.00286	3.30E-04		0.06600
MB45950	0.07	0.007	3.00E-05	0.00041	2.00E-05		0.00302

Risk Presumption	RQ	LOC
Acute High Risk	EC1/LC50 or EC5	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/NOEC	1